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Configuring the Compaq ProLiant 5000 for Microsoft Windows NT Server Environments

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Configuring the Compaq ProLiant 5000 for Microsoft Windows NT Server Environments

This white paper is intended for Compaq Field Systems Engineers (FSEs), Resellers, and customers who install and maintain Microsoft Windows NT Server on Compaq systems. The white paper provides guidelines and configuration information to help you optimally configure a Compaq ProLiant 5000 server with Microsoft Windows NT Server environments.

Additional information on the Compaq ProLiant 5000 hardware and options can be found in the technical document, *Configuring the Compaq ProLiant 5000 for Peak Performance, Document # 301A/0696.*

This document focuses on:

- Optimal configuration of PCI and EISA devices
  - Primary PCI Bus
  - Secondary PCI Bus
  - EISA Bus
  - PCI bus bridging
- Recommendations for configuring and optimizing the ProLiant 5000 in a Microsoft Windows NT Server environment:
  - Initial setup and configuration information that will provide you with the information you need to achieve the optimal performance advantages of the Pentium Pro processor
  - Information to assist you in expanding the configuration as your needs grow
- Compaq Support Software for Microsoft Windows NT 3.51 (SSD)
  - Hardware Abstraction Layer (HAL) Multiprocessor Support
  - SMART-2 Drive Array Support
  - Compaq Array Configuration Utility for Windows NT
  - SCSI Controller Support
  - Network Controller Support

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- ProLiant Storage System Support
- Systems Management Support
- Compaq Standby and Online Recovery Server Option Support
- Uninterruptible Power Supply Support

Compaq ProLiant 5000

The Compaq ProLiant 5000 is the first in a new generation of the Compaq ProLiant family of high performance servers. The ProLiant 5000 includes new features and design to achieve performance advantages and use unique characteristics of Intel Pentium Pro processors and PCI bus architecture.

The ProLiant 5000 server design includes the following new features:

- Support for the Intel Pentium Pro processors and the Intel 82450GX chip set.
  - 166 MHz processors, each with 16KB Level 1 cache and an integrated 512KB Level 2 cache.
  - 200 MHz processors, each with an integrated 16KB Level 1 cache and an integrated 256KB Level 2 cache.
- Optimization for enhanced PCI performance.
- Support for dual-peer PCI buses.
  - Primary PCI Bus
  - Secondary PCI Bus
- Supports a bridged EISA bus off the primary PCI bus.
- Support for DIMM memory technology.

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Optimizing PCI and EISA Devices

Compaq has conducted extensive testing to determine optimal configurations for achieving high performance and ease of use at the initial installation of a ProLiant 5000 system. These test include integrating the ProLiant 5000 with network operating system software, such as Windows NT Server, and installing additional peripherals when the need arises.

This section contains Compaq recommendations for configuring the ProLiant 5000 server to achieve optimal Windows NT Server performance.

The dual-peer PCI buses capabilities of the ProLiant 5000 server provide high-bandwidth I/O with two buses operating simultaneously. Dual-peer PCI buses provide an aggregate bandwidth of 267 MB/s. The I/O board has two Pentium Pro-to-PCI bridge controllers. The controllers connect the primary and secondary PCI buses to the host bus. The primary and secondary buses each have assigned functions.

The configuration recommendations presented in this document focus on:

- Primary and secondary PCI bus configurations
- Bridged controllers and the implications of adding additional bridged controllers

Primary PCI Bus

- Supports dedicated PCI slots 5-8.
- Supports the EISA bridged bus.
  - Supports up to three EISA slots (one dedicated, two shared EISA/PCI).
  - Supports integrated EISA peripherals (video, timers, keyboard, mouse).

Secondary PCI Bus

- Supports PCI on shared slots 2 and 3 and dedicated slot 4.
- Supports the Integrated 32-Bit Fast-Wide SCSI-2 controller.

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What is a Bridge?

A PCI bridge connects two independent PCI computer buses together and allows the buses to communicate with each other. By creating hierarchical PCI buses, the PCI bridge overcomes the electrical loading limits of the PCI bus.

PCI Bus Numbering

PCI buses are assigned PCI bus numbers beginning with Bus # 0 for the primary PCI bus (Slots 5-8) and Bus # 1 for the secondary PCI bus (Slots 2-4).

PCI bus numbering changes depending on how many PCI bridged controllers are installed (ex: SMART-2/P Controller) and whether they are installed in the primary or secondary PCI bus, and slot order of each bus.

For example, in the default factory configuration (Table 1), the SMART-2/P controller is installed in the primary PCI bus (Slot 5), the SMART-2/P is a PCI bridged controller causing the bus numbering to change. As stated previously, the default bus numbers for the ProLiant 5000 without any bridged PCI controllers installed is Bus # 0 for the primary PCI bus and Bus # 1 for the secondary PCI bus; adding the SMART-2/P controller to the primary PCI Bus causes the bus numbers to change to Bus # 0 for the primary PCI bus, Bus # 1 for the SMART-2/P bridged PCI bus, and Bus # 2 for the secondary PCI bus.

Compaq tested the installation and configuration of bridged PCI controllers and recommends that the configuration tables (Tables 1-6) be utilized to minimize the possibility of changing the bus numbers and causing device drivers such as the *NETFLX3.SYS* to fail when loading. The failure is due to the initial bus number used while configuring the PCI NetFlex-3 controller and adding a bridged controller that changes the bus number of the PCI bus that the NetFlex-3 controller is installed in. Windows NT does not update the network interface card configuration which causes any network interface card to fail during device driver initialization.

Any time additional bridged PCI controllers are added or removed from the primary bus of an existing configuration, the secondary PCI bus number changes requiring the network interface controllers to be reconfigured

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Following the recommended configuration tables minimizes the possibility of this occurring and having to reconfigure the NetFlex-3 controller and also gives the best performance configuration by dividing the bus load.

Factory Configuration

Table 1 describes the factory configuration with one Netelligent 10/100 TX PCI UTP network interface controller (NIC) installed in the secondary PCI bus (Slots 2-4) and one SMART-2 SCSI Controller installed in the primary PCI bus (Slots 5-8).

Table 1
Factory Configuration, Array Models

Device	Bus	Slot
10/100 TX PCI UTP Controller	Secondary	2
SMART-2/P Array Controller	Primary	5

Adding Additional Devices

Tables 2 through 6 show recommended configurations to utilize as many as four SMART-2/P Array Controllers and two Netelligent 10/100 TX PCI UTP Controllers.

Table 2
Recommended Three-Controller Configuration
One 10/100 TX PCI UTP Controller, Two SMART-2 Array Controllers

Device	Bus	Slot
10/100 TX PCI UTP Controller	Secondary	2
SMART-2/P Array Controller	Primary	5
SMART-2/P Array Controller	Secondary	3

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Table 3
Recommended Three-Controller Configuration
Two 10/100 TX PCI UTP Controllers, One SMART-2 Array Controller

Device	Bus	Slot
10/100 TX PCI UTP Controller	Secondary	2
SMART-2/P Array Controller	Primary	5
10/100 TX PCI UTP Controller	Primary	6

Table 4
Recommended Four-Controller Configuration
Two 10/100 TX PCI UTP Controllers, Two SMART-2 Array Controllers

Device	Bus	Slot
10/100 TX PCI UTP Controller	Secondary	2
SMART-2/P Array Controller	Primary	5
10/100 TX PCI UTP Controller	Primary	6
SMART-2/P Array Controller	Secondary	3

Table 5
Recommended Five-Controller Configuration
Two 10/100 TX PCI UTP Controller, Three SMART-2 Array Controllers

Device	Bus	Slot
10/100 TX PCI UTP Controller	Secondary	2
SMART-2/P Array Controller	Primary	5
SMART-2/P Array Controller	Secondary	3
10/100 TX PCI UTP Controller	Primary	6
SMART-2/P Array Controller	Secondary	4

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Table 6
Recommended Six-Controller Configuration
Two 10/100 TX PCI UTP Controllers, Four SMART-2 Array Controllers

Device	Bus	Slot
10/100 TX PCI UTP Controller	Secondary	2
SMART-2/P Array Controller	Primary	5
SMART-2/P Array Controller	Secondary	3
10/100 TX PCI UTP Controller	Primary	6
SMART-2/P Array Controller	Secondary	4
SMART-2/P Array Controller	Primary	7

In Table 6, by adding the SMART-2/P controller to the primary PCI bus (Slot 7), the PCI bus number of the secondary PCI bus changes causing the *NETFLX3.SYS* device driver to fail while attempting to load.

The following steps highlight the process to correct the issue:

- Double-click the *Network* icon from the Control Panel, record pertinent information on the network adapters (IP address, etc.)
- Close the *Network Settings* dialog box.
- Double-click the *Compaq Net* icon to launch the *Compaq Advanced Network Control Utility* from the Control Panel.
  - Highlight the failing adapter and select the *Uninstall* option.
  - Highlight the adapter again and select the *Install* option.
- Close the *Compaq Advanced Network Control Utility* dialog box.
- Enter the information (IP address, etc.) recorded earlier on the network interface card being reinstalled in the *Network Settings* dialog box..
- Shutdown and reboot the server.

NOTE: Any time additional bridged PCI controllers are added or removed from the primary bus of an existing configuration, the secondary PCI bus number changes, requiring the network interface controllers to be reconfigured.

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Compaq Support Software for Windows NT

The Compaq SSD for Windows NT 1.18 contains 2 diskettes. The first diskette contains all the main setup installation files and the following drivers for Windows NT 3.51 and the Compaq ProLiant 5000:

- Hardware Abstraction Layer (HAL)
- SCSI (32-Bit SCSI-2 Controllers and Drive Array Controllers)
- Network (NetFlex Family of Controllers)
- System Management

The second diskette contains the following drivers:

- Online and Standby Recovery Server
- Uninterruptible Power Supply (UPS)
- Remote Insight Management

NOTE: All Compaq device drivers are available on the Compaq Software Support Diskette (SSD) v1.18 or later, refer the *NTREADME.HLP* file included on the SSD for installation instructions.

Hardware Abstraction Layer Multiprocessor Support

This section provides an overview of the Hardware Abstraction Layer support for the Compaq ProLiant 5000. The Compaq ProLiant 5000 is a Multiprocessor Specification-based server and takes advantage of additional capabilities provided by Intel MPS capable processors. The HAL is a layer of software that interacts directly with the computers hardware and is one of the modular components that make up the Windows NT operating system.

The Microsoft Multiprocessor HAL (*HALMPS.DLL*) included with Windows NT will function on the Compaq ProLiant 5000 server and provides basic HAL functionality

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The Compaq Multiprocessor HAL (*HALMPS.DLL*) provides the same basic functionality as the Microsoft Multiprocessor HAL and includes additional functionality to take advantage of the features built into the Compaq ProLiant 5000.

Additional features include:

- Performance Monitoring support.
- Insight Management Agents support that provide error logging features to the system management driver.
- Problem resolution with built in mechanisms for Compaq device drivers to dynamically call the HAL and intuitively determine which updates have been applied.
- Announcement of Compaq HAL during blue screen initialization.
- Printer support during blue screen crashes.
- Mechanism to control thread time slice.
- Mechanism to determine Compaq problem resolution.
- Bus mastering of Direct Memory Access (DMA) above 16-megabyte limit.
- Problem resolution for IOCheck during a Non-Maskable Interrupt (NMI).
- Problem resolution for a PCI map register limitation.
- Support for greater than 8 PCI Buses.

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Smart-2 Drive Array Support

This section provides an outline of the device drivers required to support the SCSI Managed Array Technology (SMART-2/P and SMART-2/E) Controller installation. The Compaq Support Software Diskette for Windows NT (SSD) v1.18 or later is required to support the SMART-2 Array Controller on the ProLiant 5000.

The SMART-2 Controller provides improved performance over other array controllers in many environments and capacity expansion. The SMART-2 Controller is a dual channel 32-Bit Fast-Wide SCSI-2 array controller. It provides you with an online expansion option of adding more disk drive to an existing logical drive configuration, which results in more fault tolerant storage capacity.

The Microsoft Windows NT 3.5x device driver *CPQARRAY.SYS* does not contain support for the SMART-2 Array Controller. The device driver *CPQARRAY.SYS* included on the Compaq Software Support Diskette for Windows NT (SSD) v1.18 or later has the latest device information and enhancements required to support the SMART-2 Array Controller on the ProLiant 5000 including:

- Compaq SMART Controller Family
  - SMART Array Controller.
  - SMART-2 Array Controller.

    SMART-2/E Array Controller

    SMART-2/P Array Controller

Compaq Array Configuration Utility for Windows NT

If installing or configuring any SMART-2 Controllers in your system, use the Compaq Array Configuration Utility for Windows NT to configure these controllers. The Array Configuration Utility is a graphical-based application that helps you configure the SMART-2 Array Controller.

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The Array Configuration Utility gives you the ability to do on-line capacity expansion which allows you to change an existing data storage configuration even in a fault tolerant configuration without requiring a data tape backup and restore cycle. If using hot-pluggable drives, storage expansion can be performed online, without shutting down the server.

The Array Configuration Utility provides the following configuration benefits:

- Illustrates the controller configuration in an easy-to-understand graphical format
- Provides descriptions of various configuration errors
- Contains configuration wizards that walk you through the configuration process
- Suggests optimal configuration and fault tolerance for controllers that are not configured

SCSI Controller Support

The ProLiant 5000 has an Integrated 32-Bit Fast-Wide SCSI-2/P Controller and requires the *CPQ32FS2.SYS* device driver from the Compaq Software Support Diskette (SSD) for Windows NT v1.18 or later in order to obtain full feature support.

The Microsoft Windows NT installation process automatically installs the *NCR PCI (53c810) SCSI* driver which only provides basic functionality for the Compaq ProLiant 5000 Integrated 32-Bit Fast-Wide SCSI-2/P Controller.

The *CPQ32FS2.SYS* device driver features:

- Enhanced performance
- Insight Management Agents for Windows NT support
- Support for the ProLiant Storage System

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Network Controller Support

The Compaq ProLiant 5000 server includes a 10/100 TX PCI UTP Controller. The network device drivers to support the NetFlex and Family of Network Controllers are included in the Compaq Software Support Diskette (SSD) v1.18 or later. The Compaq drivers conform to Microsoft NDIS 3.0 miniport architecture.

The following sections compare and contrast the component support included with the Microsoft base product to the Compaq enhanced driver.

Microsoft Network Controller Drivers

The Microsoft base product provides driver support for most Compaq network controllers. However, the base product does not include all the latest enhancements that take advantage of the features built into the Compaq hardware.

Compaq Network Controller Drivers

This section discusses the Compaq network controller device drivers and the support available with these drivers.

- *NETFLX3.SYS* device driver is NDIS 3.0 miniport compliant. The *NETFLX3.SYS* device driver supports today's industry standard Ethernet topologies and the newer 100 Mb/s, 100Base-TX, and 100VG-AnyLAN technologies.

  This driver includes performance tuning algorithms that dynamically adjust settings on the adapter to optimize throughput and utilization. The *NETFLX3.SYS* driver can support as many controllers as there are bus master slots in a server.

  The NetFlex-3 driver for Windows NT supports the following controllers:

  - Compaq NetFlex-3/P Controller
  - Compaq NetFlex-3/E Controller

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The NetFlex-3 driver currently supports these controllers when configured with one of the following modules:

- 10Base-T UTP/BNC Module
- 100VG-AnyLAN UTP Module
- 10/100Base-TX UTP Module

The NetFlex-3 driver also supports the following non-modular controllers:

- Compaq Netelligent 10/100TX PCI UTP Controller
- Compaq Netelligent 10T PCI UTP Controller

Benefits of using Compaq developed network device drivers include:

- Support for full-duplex operation in 10BaseT and 100Base-TX environments. Full duplex allows simultaneous two-way transmission between nodes while eliminating collisions. The performance transmission and efficiency are increased by doubling the bandwidth of 10Base-T cabling to 20 megabits/second (Mb/s).
- NetFlex Advanced Registry Parameters that support your Windows NT configuration are added to the Windows NT Registry with default values. These parameters should not be changed. However, you may modify optional parameters, if needed. A complete list of the parameters and a description for each is included in the Compaq SSD for Windows NT *NTREADME.HLP* file.

CAUTION: Compaq cautions you to modify Registry Parameters at your own risk. Using the Registry Editor incorrectly might cause serious, system-wide problems. This includes registry corruption that might cause you to have to reinstall Windows NT.

- Support for Compaq Insight Management Agents for Windows NT.

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- The *NETFLX3.SYS* driver supports additional Performance Monitor counters. Compaq has developed a Performance Monitor utility that installs or removes counters that support the Compaq NetFlex-3 Performance Monitor DLL. This utility allows you to visually measure performance when you select the Windows NT Performance Monitor utility *PERFMON.EXE*. The counters that you select provide detailed information about transmit and receive operations for the Compaq NetFlex-3 Controller. These counters are helpful in understanding the performance characteristics for a particular NetFlex-3 Controller and can help pinpoint potential network performance bottlenecks.

Compaq Advanced Network Control Utility

This new application uses a Graphical User Interface (GUI) that allows a user to install, configure, update, and monitor the status of all Compaq network controllers containing the TLAN chip set. The Compaq Advanced Network Control Utility includes features such as:

- Setting up a pair of controllers for duplexing as well as stand-alone network controllers.
- Ability to graphically monitor status and configure stand-alone and redundant network controllers.
- Ability to reset the network controllers and switch active controllers instantaneously in a controller pair.
- Ability to change the controller pair operating mode and primary controller settings instantaneously.

The Compaq Advanced Network Control Utility uses the *NETFLX3.EXE* file to configure network controllers for redundancy or stand-alone configurations. Also, you can use the *NETFLX3.EXE* file to view controller status or network statistics.

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ProLiant Storage System Support

Compaq provides a device driver, *PRLNTSS.SYS*, that supports the ProLiant Storage System when it is attached to the Compaq ProLiant 5000 integrated 32-Bit SCSI-2 Controller or additional Compaq 32-Bit SCSI-2 Controllers installed in the unit.

The Microsoft Windows NT base product does not include support for the ProLiant Storage System , the driver must be installed from the Compaq Software Support Diskette (SSD) v1.18 or later.

PRLNTSS.SYS provides the following features:

- Supports Compaq Insight Management Agents for Windows NT 3.5x
- Intelligent management of the on-line status indicator on ProLiant drive trays.
- Writes to the Windows NT Event Log for any ProLiant alarms such as fan failures, critical temperature conditions, side door open, and redundant power supply fault.
- Writes to the Windows NT Event Log to record critical condition and hot plug events.
- An interface that allows external management of the drive tray indicators.

System Management Support

Compaq provides systems management support for Windows NT with *SYSMGMT.SYS*, the Systems Management driver. This driver supports Compaq Server Management (CSM) and Automatic Server Recovery (ASR). These systems management features are available on the ProLiant 5000 server.

The *SYSMGMT.SYS* driver supports the following features:

- Logging of critical errors
- Automatic Server Recovery
- Fan outage and temperature detect alarms
- Logging of corrected memory errors

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- Notification of Redundant Power Supply status
- Checking of the Real Time Clock
- Bus Utilization Statistics

This device driver is required to support Compaq Insight Management Agents for Windows NT 3.5x. The System Management driver depends on the Compaq HAL for support. If the System Management driver is installed, the Compaq HAL is automatically installed at the same time. You will need the Compaq SSD for Windows NT to install the driver and the Compaq System Configuration Utility to configure and enable the driver.

Compaq Standby and Online Recovery Server Option Support

The Compaq Standby and Online Recovery Server Option is designed to improve the fault recovery time of a mission-critical server. If the Primary Server fails, a method is in place to provide the automatic switchover of the ProLiant Storage System to a Secondary Server.

Before you can use the Compaq Recovery Server Option support with Microsoft Windows NT Server Version 3.5x you must install the Compaq Recovery Server Option Kit (PN 213187-001) from Compaq.

You will need:

- Compaq Insight Manager 3.0 or later
- Compaq Insight Management Agents for Windows NT Version 3.5x

The Compaq SSD for Windows NT v1.18 or later contains the support software for the Compaq Recovery Server Agent. However, you must configure the Recovery Server Option hardware components with the System Configuration Utility before the Compaq SSD for Windows NT Setup program can properly install the support software.

The Compaq Recovery Server Agent software support must be installed after the system is running Windows NT 3.5x.

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If one system fails, the surviving server detects the failure and causes the switch of the drives from the failed server to itself. This feature is included in the Compaq SSD for Windows NT as option *Compaq Standby Recovery Server* during set up. The Standby Recovery Agent driver, *CPQRSYS.EXE*, supports Compaq Insight Management Agents for Windows NT 3.5x.

NOTE: The Compaq Standby Recovery Server Option is dependent upon Compaq System Management support to function properly. To correctly install the Standby Recovery Server Option you must load both drivers during installation.

Uninterruptible Power Supply Support

The Compaq Uninterruptible Power Supply (UPS) provides battery-backup power to your system when the local power fails. The Compaq UPS support software notifies you that the system is going to shut down due to a power failure. However, the Compaq UPS does require the Compaq UPS support software for full feature support.

When installed, the Compaq UPS support driver, *CPQUPS.DLL*, runs as a Windows NT Service. The support driver adds the following functionality:

- Provides an extra level of fault tolerance support for environments running critical applications.

  NOTE: The Compaq UPS support driver supplements the Microsoft UPS support, it is not a replacement.

- Ability to start and stop the UPS through the Windows NT Services Control Panel application of Windows NT.
- Compaq Insight Manager and Insight Management Agents supports the Compaq UPS.
- Ability to tune related parameters using the Registry Editor.

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